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BOROUGH OF LEICESTER.

REPORT

BY

W. ELGAR BUCK,

AND

GEORGE COOPER FRANKLIN,

ON THE

EPIDEMIC DIARRHŒA

OF

1875.

Presented to the Sanitary Committee, and ordered to be Printed.

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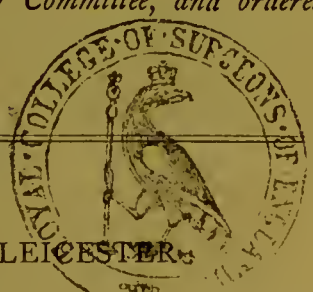
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LEICESTER, DECEMBER 8TH, 1875.

To the Sanitary Committee of the Borough of Leicester.

GENTLEMEN,

We have the honour to present to you our Report on the Infantile Diarrhœa of Leicester.

The Report is divided into three Sections.

SECTION I. consists of information obtained in answer to enquiries made as suggested in our instructions.*

SECTION II. treats of Infantile Diarrhœa generally, and of its nature in Leicester.

SECTION III. treats of the Sanitary condition of Leicester, and more especially of the local conditions in relation to the excessive rate of Infantile Diarrhœa; and includes some suggestions for the mitigation of the disease.

We have to thank Dr. CRANE, Mr. STEPHENS, and Mr. STOREY, for much valuable support and assistance.

We also wish to bear testimony to the efficient services rendered to us by your Sanitary Inspectors, Sergeants BUXTON and BRALEY.

We have the honour to be,

Gentlemen,

Your most obedient Servants,

WILLIAM ELGAR BUCK, M.A., M.B.

GEORGE COOPER FRANKLIN, F.R.C.S.

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* "That the Gentlemen appointed be instructed to visit every house in which a death of a child, under five years of age, from Diarrhœa, has occurred since the first July last; that they examine the sanitary condition of the premises, including the water supply, the closet provision, the condition of drainage; and ascertain particulars of the illness, and whether deceased was under regular medical, or what other advice; the diet of the child, with especial reference to milk, other than that of the breast; the usual state of the health of the parents, and their occupation, and whether or not, the child was under the mother's personal care at the time of the attack; and generally to enquire into all facts which in their judgment will tend to throw any light upon the causes of the excessive Infantile Mortality, from Diarrhœa in Leicester."

"That the enquiries be extended to those localities in which Infantile Diarrhœa is now prevailing, although no death may have been reported."

"That the Gentlemen be requested to confer together, and also with Dr. CRANE, the Officer of Health, previous to, and during the enquiry, and to compare the result of their enquiries; and to make either a joint or separate report thereon to the Sanitary Committee, with such practical suggestions as may occur to them, and with as little delay as may be compatible with a thorough investigation of the subject entrusted to their enquiry."

SECTION I.

The number of fatal cases, returned as "Diarrhœa," that occurred in children under 5 years of age, from July 1st, 1875, until September 30, 1875, in the Borough of Leicester, was 238. These are all included in the Table of Streets* and are all marked on the Map*; so it will be observed that particulars as to location have been noted in all cases. Number of Cases.

Full particulars were not obtained in the following 22 cases :— 22 Exceptions.

SERIES A.

1 ...	10	Infant illegitimate.
2 ...	29	,, ,,
3 ...	63	,, ,,
4 ...	77	,, ,,
5 ...	118	Mother since dead.
6 ...	131	People gone.
7 ...	132	,, ,,
8 ...	137	Infant illegitimate.
9 ...	140	,, ,,

SERIES B.

10 ...	2	,, ,,
11 ...	6	,, ,,
12 ...	7	Not diarrhœa.
13 ...	27	People gone.
14 ...	40	,, ,,
15 ...	41	,, ,,
16 ...	48	,, ,,
17 ...	52	,, ,,
18 ...	57	,, ,,
19 ...	60	,, ,,
20 ...	61	,, ,,
21 ...	66	Not diarrhœa
22 ...	71	People gone

Thus it is seen that full particulars have not been obtained ;

* See appendix.

I.—Where the people, parents, or relatives had left the neighbourhood, or 'gone altogether:' This happened in 11 instances, or at the rate of 4.6 per cent.

II.—Where the infant was illegitimate: This happened in 8 cases, or at the rate of 3.3 per cent.*

III.—Where most satisfactory evidence showed that the infant had had no diarrhœa at all: This happened in 2 cases, or at the rate of 0.84 per cent.

IV.—Where the mother had since died, and no trustworthy information could be obtained: This happened in 1 case only.

Thus for tabulation and consideration generally, there remain 216 cases out of the 238 a reduction of 22, or at the rate of 9.2 per cent.†

Accuracy of Information.

It may here be remarked that the information asked for with regard to these cases was, in the vast majority of instances, most willingly given; given too with so much apparent honesty and truthfulness as to leave on our minds the impression that we had obtained, at any rate approximately, accurate information.

Only in one or two instances did it happen that the parent or relative, as the case might be, hesitated in answering our questions.

Ages of Parents.

We propose, in the first place, to consider the ages of the parents. It was thought to be a matter of importance to ascertain the ages of the parents, at the time of the death of the infant:

Of the 216 fathers, we find from our tables, the average age for each to be 30.8 years.

Of the 216 mothers we find the average age for each to be 29.9 years. The youngest parents were aged respectively

* For obvious reasons particulars as to parentage, &c., could not be obtained.

† With regard to sanitary particulars, water supply, etc., we have information in 227 cases, a reduction of 4.6 per cent.

For the purposes of reference and tabulation, it has been found convenient to divide the total list into Series A and Series B. Series A to comprise the Eastern district of the town, and Series B the Western. In Series A there are particulars of 143 cases out of 152, and in Series B, out of 86 cases, 73 have been fully considered.

17 (father), and 20 (mother); the oldest 60 (father), and 38 (mother).

In manufacturing towns—Leicester for example—it is constantly observed that the infant population dies because the parents are so young; and that, in the comparatively early marriages of our working classes, is one fact that assists in explaining why the infants are weakly and short-lived. Early Marriages.

To discuss the question of early marriages would be out of place here. It is not denied that too early marriages do take place, and that they are prejudicial in respect of offspring; but this subject hardly affects the main question we have under our consideration, when we find that the ages of the parents are, on the average (viz., 30 and 29), such as to ensure, cæteris paribus, a strong and healthy offspring.

We consider next the health of the parents. Health of Parents.

Some explanation is necessary with regard to our classification in this respect. We have reported on health as being good, indifferent, or bad.

With respect to the fathers: by 'good' is to be understood that their present state of health enables them to work without discomfort; by 'indifferent' we understand that the parent may occasionally, in consequence of some chronic ailment (e.g. bronchitis in the winter), have to give up his work; by 'bad' is indicated a state of confirmed or hopeless disease. Fathers.

The same terms are made use of in describing the healths of the mothers, and are to be interpreted in much the same way. Mothers.

Obviously such information cannot be exact, but we have no doubt that the general conclusions under this head are fairly correct, and tend to convey true impressions. Great attention was paid to this information, and as the result of our tabulation we have the following list:—

That of the 216 fathers.

185 are in good health, or 85.6 per cent.
27 „ indifferent „ 12.5 „
4 „ bad „ 1.8 „

That of the 216 mothers.

154 are in good health, or 71.2 per cent.
57 „ indifferent „ 26.3 „
5 „ bad „ 2.3 „

Thus we find, that of the total of 432 parents, 339 or 78.4 per cent. are in good health ; in other words, are in a state of health not incompatible with the capability of producing a strong and healthy offspring.*

We now consider the occupation of the parents.

Occupations of Parents.

If in Leicester the excessive infantile mortality from diarrhœa arises from an unwholesome condition uniformly distributed throughout the town, it may be justly asked, Why do not the infants of the wealthier classes suffer equally with those of the so-called working-classes? This subject will be referred to later. It is sufficient now to note the fact that, with three or four exceptions, the parents are to be found among those whose occupations are in factories, small shops, workshops, warehouses, &c.

No special reference is necessary further as to the occupations of the fathers. Almost invariably when the inspection was being made, the "master was gone to work;" but with regard to the mothers and their occupations, some further remarks are required.

Of the 216 mothers, we find that 163 are employed in housework ; some 24 of whom are engaged at home in work other than usual household duties, such as machine work or seaming; the remaining 53, or 24.5 per cent. go out to work to the warehouse, factory, or hawking.†

Reference to Report of Dr. Crane.

In 1873, Dr. Crane reports that of the 283 mothers whose infants died of diarrhœa, 82 or 28.9 per cent. went out to work. This is a somewhat higher rate, but it is so

* If it had been possible for us to have investigated the facts for the population of Leicester, whose children did not die of diarrhœa, it is probable we should have had to record proportions not greatly differing from the above.

† It must be remembered that this is no index as to the number of women employed in factories generally, the percentage of which class varies so much in different towns ; but refers exclusively to the mothers of the 216 cases under review.

approximately the same as to confirm the correctness of both returns.

We wish to draw particular attention to this: That 24.5 per cent. only of nursing mothers go out to work is a fact much at variance with current opinion. It is stated often that anyone can tell how it is that the infants die, "that their mothers go out to work, and that the infant does not receive proper food and attention."

Maternal Neglect.

We here do not hesitate to state our opinion that the nursing mothers do not, as a rule, neglect their children. Where the infant has improper food, or clothing, it is from ignorance on the parent's part of the ordinary laws of health, or from inability, through poverty, to supply it with those necessaries which are requisite for its proper rearing and maintenance.

That cases of wilful neglect do occur in the large towns, and in Leicester among them, we do not deny; but we do say that, as far as our observations go, the "neglect of mothers" is not a main cause of the infantile mortality. We are well aware that this opinion is directly opposed to that of many writers and others. It is an opinion, however, which we have deliberately formed (we have had good opportunities for judging), and we do not express it without a deep sense of its importance and responsibility.

Age of Infants.

We consider now the age at which the infants die, and the duration of illness.

Ages of infants at time of death.

Infants aged,	Series A.	Series B.	Total.
One month or under ...	13	9	22
One month to three ...	36	14	50
Three months to six ...	38	24	62
Six months to one year	34	18	52
Over one year and up to five years.....	22	8	30
	143	73	216
Youngest infant	11 days	12 days	
Oldest	3 years	3 years	

Thus, with regard to age at the time of death, out of 216 infants, 186 were a year or under, and 30 or 13.8 per cent. above one year.

In 1873, Dr. Crane reports, that of 283 infants that died from diarrhœa, 269 were one year and under, and 14 above or only 4.9 per cent.

It will be observed that the greatest number of deaths, 62, took place in infants between three and six months of age; and the smallest number, 22, in those of one month or under. The figures show also that in both districts of the town* the proportion of deaths to age is much the same, except that in the Western district, Series B, the increase of deaths of infants aged from three months to six is more marked.

Duration of illness of infants.

Time.	No. of infants. Series A.	Series B.	
1 day	5	2	7
2 days	7	3	10
3 ,, ...	9	7	16
4 ,, ...	15	4	19
5 ,, ...	5	3	8
6 ,, ...	1	1	2
7 ,, ...	23	7	30
1 week to 2.....	34	26	60
2 weeks to 3	12	8	20
Over 3 weeks	32	12	44
	143	73	216

Thus of the total of 216 infants,

92 were ill for 1 week or under
60 ,, ,, between 1 and 2 weeks.
20 ,, ,, between 2 and 3 weeks.
44 ,, ,, over 3 weeks

Thus 42.5 per cent., or nearly half the total number, were ill for one week or under, and no less than 79.6 per cent. were ill for a period less than three weeks.

* See page 6 foot note.

Enquiries were made also with regard to the administration of patent medicines, such as soothing powders, &c., and whether or no the infant was in a burial club. We find that in 84 instances out of the 216, the mother was in the habit of giving "soothing powders," or some cordial, and that in 35 instances the infant was in a burial club. Patent Medicines.

The former of these two facts is not without interest—for these powders and cordials all contain some preparation of opium, in varying and uncertain quantities.

We consider it to be a matter of deep concern that there should be no restraint whatever as to the amount of "dosing" an infant may receive at the hands of its nurse.* In the reports of many medical officers of health through the country, this free trade in drugs, poisonous in fact as far as infants are concerned, is alluded to. We have no reason to suppose that Leicester is remarkable in this respect.

This does not bear directly on the subject of our enquiry, but having made it a point for investigation, it is interesting to have some idea of the extent to which this custom exists.

Acting on the suggestion of one of the members of your Committee, we noted the cases where the infant was insured in a burial club, as stated above; this occurred in 35 instances. Burial Club.

Attention is now directed to the Infant: Particulars as to Infants.

I.—Whether healthy or weakly when born.

II.—As to suckling.

III.—As to nursing generally, nourishment, &c.

IV.—As to medical attendance.

I.—The terms "healthy" and "weakly" are to be used in a broad, comprehensive sense. Where we have been told that the infant was "beautiful born," or that it was "quite well until this last illness," we have had no hesitation in returning it as "healthy." On the other hand, where the infant was "ailing from the birth," or was "never strong," we have classed it as "weakly."

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* It may be remarked that opium is ordinarily supposed to check rather than to produce diarrhœa.

Thus :—

Infants reported as being healthy when born :

Series A	102
„ B	47

Infants reported as being weakly when born :

Series A	41
„ B	26

So of Series A, 28.6 per cent. were born weakly ; of Series B, 35.6 per cent. ;* of the total 216 infants, 149 or 68.9 per cent. were born healthy.

II.—As to suckling, we have tabulated the cases in the following manner :—

	Series A.	Series B.
Infants who were wholly suckled.....	19	3
„ „ „ partially	80	53
„ „ „ either not suckled or were weaned	44	17

Thus we have a total of those infants

Wholly suckled	22
Partially	133
Nil	61
	216

III.—As to nursing.

Enquiries were made in every case as to who nursed the infant during its illness. We find that

	Series A.	Series B.
The nursing was by the mother in	112	61 cases.
„ „ „ grandmother	16	6 „
„ „ „ nurse or neighbour...	14	4 „
„ „ „ aunt	0	2 „
„ „ „ sister	1	0 „
Totals.....	143	73

* Reference will be made in Section III. to this difference.

Thus, of the 216 infants,

173	were	nursed	by	their mothers
22	,,	,,	,,	grandmothers
18	,,	,,	,,	a nurse or neighbour
2	,,	,,	,,	an aunt
1	was	,,	,,	a sister
216				

By this table we see that 91.6 per cent. of the infants were nursed by the mother, grandmother, or relative; while only 8.3 per cent. were nursed by either a professional nurse or by a neighbour. In one case we found that the "nurse" was aged 13.

We may here make some remarks as to the milk supply and nourishment generally.

In answer to our questions, we were told in five or six instances that the milk (cow's milk) was not so good as it should be; in every other case the milk supply was stated to be "good."

We took notes with regard to "supplementary food" in every case, and though we obtained a mass of information on this point, it is difficult to convey it in a concise and comprehensive manner.

The food consisted, for the most part, of arrowroot, corn flour, sago, "entire wheat flour," "Neave's food." In some cases the child, if able, had bits from the parents' tables.

The general impression received, with regard to this subject, was that the parents rather overfed than underfed the infants, using the above-mentioned articles of diet.

It is much to be regretted that these mothers do not understand the value of milk (which is the natural diet for the infant). They think that unless they try first one and then another of these patent foods—perhaps all—that they are not doing all they can for the child. It will have been noticed that the number of infants wholly suckled, viz., 22, (or 10.1 per cent.) is very small, and of these who had milk

(cow's milk) alone, we found but three or four out of the total number.*

IV.—As to medical attendance.

Of the total 216 cases,

We find that 211 were attended by legally qualified practitioners, and 5 by Mr. Mortimer, Applegate street.

Sanitary Condition of Houses.

We consider in the next place our tabulation of the general sanitary condition of the houses where these deaths took place.†

Series A.

Particulars were obtained in 149 cases out of 152. (See foot note 2, page 6.)

I.—Water supply.

102 houses supplied with waterworks water.

47 „ „ „ well water

II.—Closet accommodation.

Water-closets in.....	63	instances
Pan	37	„
Midden stead.....	49	„
	149	

III.—As to yard.

In the 149 premises inspected, in one case there was no yard, in thirty cases the yard was "small and confined," the remainder are described as "open."

Series B.

Particulars were obtained in 78 cases out of 86. (See foot note 2, page 6).

I.—Water supply.

61 houses were supplied with waterworks water.

17 „ „ „ well water.

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* "Mixing the milks." There is an opinion among some of the mothers that mixed milks do not agree—that is, the mother's milk and the cow's milk. We found this to be the case in 6 instances, and enquiries were always made on this point.

† This subject is fully treated in Section III, but the particulars of tabulation are here introduced to complete Section I.

II.—Closet accommodation.

Water closets in.....	26	instances.
Pan.....	30	,,
Midden stead.....	22	,,
	78	

III.—As to yard.

In the 78 premises inspected, in two cases there was no yard, in twenty cases the yard was "small and confined," the remainder are described as "open."

In reference to the supply of waterworks water, it is seen that 71.8 per cent. of the houses were supplied in this way. In 1873, Dr. Crane reports that out of the 283 houses where deaths occurred from diarrhœa in infants, 187, or 66.0 per cent. were supplied with waterworks water.

SECTION II.

In discussing the subject of Infantile Diarrhœa, and its extraordinary prevalence in Leicester, some remarks are necessary with regard to the disease as ordinarily recognised, its various causes, and the various conditions under which it is observed, as well as its relation to some other diseases.

Definition of Diarrhœa.

Diarrhœa is defined thus :—

"Frequent loose alvine evacuations, without tenesmus; due to functional or organic derangement of the small intestines, produced by causes acting locally or constitutionally."*

By infantile diarrhœa we understand the affection as it occurs in the infant of one year or under. We here note that our inspection practically resolved itself into one concerning the deaths of infants of this age; for, as shown in Section I,† of the total number 13.8 per cent. only were over one year, and no case occurred in an infant over three years.

Briefly considered, then, diarrhœa in the infant occurs,

Classification.

I.—As symptomatic of disease, constitutional or otherwise.

II.—As a sequel of acute disease.

III.—As constituting a disease in itself.

I.—As a symptom of constitutional disease, it is well marked, sometimes, in the infant suffering from syphilis. We observed some few cases where syphilis undoubtedly had been the cause of the diarrhœa and consequent death.‡ In strumous and ricketty infants diarrhœa is sometimes a prominent symptom, and not unfrequently kills. It is recognised also as a symptom in "consumption of the lungs" (phthisis), and in "consumption of the bowels" (tabes mesenterica).

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* "System of Medicine," second edition, Reynolds, vol. I., p. 642.

† Page 10.

‡ We learn that it is deemed inexpedient by medical gentlemen to return these cases as "syphilis," and that they are returned either as "diarrhœa," "atrophy," or "marasmus."

With regard to the disease known as the "thrush" (called in Leicester the "frost"), some authors, more especially the French, look upon diarrhœa as a symptom, others regard it as an accidental complication.

Again, in some acute diseases, as, for example, pyœmia —typhoid fever—diarrhœa almost invariably occurs.

II.—As a sequel of acute disease, for instance, measles, scarlet fever, or, in fact, those diseases which produce cachexia. Diarrhœa occurring in an infant whose system has become debilitated by an acute attack will often prove fatal.

III.—As constituting a disease in itself—a primary disease—in which the causes, whatever they may be,* seem to act as irritants directly on the mucous surface of the intestine, so giving rise to diarrhœa of a serious or fatal nature in a previously healthy subject.

It is this form of diarrhœa which is of the greatest importance, as we shall endeavour to show, with regard to the present enquiry. If it had been possible, the cases of diarrhœa that occurred under this head would have been considered separately from those cases in which it was a symptom of disease, rather than the disease itself. Such an arrangement was found to be impracticable, opinions had to be formed from the clinical history and symptoms of a case, without any of that assistance which pathological research, carried even to a small extent, would have given.†

Relation to Dentition.

It is not forgotten that this (one year or under) is the age when the infant "is about its teeth," and we prefer to allude to dentition under this head, rather than to consider the process of dentition, as a cause of the diarrhœa.

Diarrhœa is very common during dentition, but is by no means necessary for its performance.

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* These are considered as we proceed; we may here mention, for example, indigestible, unusual, and impure food as a direct cause.

† It is a matter of deep regret that there is still so great a repugnance in our country towns to "post mortem" examinations. In an enquiry of this nature, as we shall have occasion to observe, some pathological observations would be of great value.

"The previously healthy, well-nourished child is at first but little affected by this diarrhœa, but some fatal judgement often asserts it to be a safety-valve that protects the child from convulsions during teething, and that must not be stopped."*

If we had taken the explanations of the mothers, we might return 80 per cent. of these fatal cases as having been due entirely, or in greater part, to teething.†

Thus far it is observed that we have briefly alluded to those causes and conditions under which diarrhœa ordinarily occurs in infants wherever they may be; and we have no reason to suppose that the diarrhœa symptomatic of syphilis, for example, on the one hand, or accompanying dentition on the other, is any more fatal in Leicester than elsewhere.

Heat Theory.

We now come to consider the time of year when infantile diarrhœa is so prevalent, and as Heat has been prominently brought forward as a cause, we propose to consider this subject at some length.

The occurrence of diarrhœa during the Summer and Autumn in the North of Europe has long been recognized. The American authors speak, too, of the "Summer Disease." In speaking of this disease Trousseau, a celebrated French author, while regretting that custom compelled him to use the term "Choléra Infantile," says, "From all time, one has observed it each year, in the warm season it shows itself in all countries."‡

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* "Niemeyer's Practical Medicine," 8th edition, vol. I., p. 549.

† Dr. Eustace Smith says, "We find that looseness of the bowels is a more common accompaniment of dentition in summer and autumn than in winter."—"Wasting Diseases of Children," p. 65.

‡ Si j'aceept la dénomination de *choléra infantile*, c'est qu'elle est, chez nous, consacrèe par l'usage, et que je suis ennemi de tout nèologisme inutile, dés que l'on s'èntend snr la signification attribuèe anx mots. Autrement, le titre de *maladie d'été*' conviendrait, à mon avis, beauconp mieux à la maladie dont je vais aujourd'hni vous entretenir.

Ce cholérà infantile, en effet, diffère essentiellement du choléra-morbus asiatique, lequel n'épargne d'ailleurs pas les infants en bas âge.

L'influence saisonnère qui, en Amerique, lui a valu la dènomination de *maladie d'été*', parait être la cause principale qui, en dehors de l'individu, agisse sur sa production. De tont temps on l'a observée; chaque annèe, dans la saison chande, elle se montre dans tous les pays."

Clinique Medicale. Part A. Trousseau, Tome second, pp. 442, 1862.

Relation to Cholera.

It is most important that the distinction between this "Summer Diarrhœa" and cholera should be insisted upon. That epidemic diarrhœa does not go parallel to cholera we have evidence in the subjoined tables.* Here we see the relations of cholera and diarrhœa in England and Wales, London, and Leicester. With regard to Leicester and its comparative freedom from cholera, we shall have occasion to speak again.† Now we observe the fact that, while summer diarrhœa is extraordinarily prevalent, cholera is almost unknown. Again, the regularity with which summer diarrhœa prevails epidemically commencing each year in June, and lasting until the end of September, is very different from the occasional visitations of cholera.

Relation to Typhoid Fever.

We now consider, briefly, Summer diarrhœa in its relations to Typhoid (Enteric) Fever.

The notion that Typhoid Fever is most prevalent in England in the Autumn season, has suggested a connection or relationship between it and epidemic diarrhœa. Dr. Tatham,‡ in referring to this subject says, "Much of the disease occurring among young children during the Autumn, and returned by the Registrar as "diarrhœa," would be more correctly described as '*Fever of a low enteric type.*'"

* Place.	Population 1861.	Cholera. 1849.	1854.	1866.	Diarrhœa. 1849.	1854.	1866.
England & Wales	20,066,224	53,293	20,097	14,378	18,887	20,052	17,170
London	2,803,989	14,137	10,738	5,596	3,899	3,147	3,147
Leicester	68,056	2	3	3	75	146	147

The above in rates per million on population living.

	Cholera. 1849.	1854.	1866.	Diarrhœa. 1849.	1854.	1866.
England and Wales	3,034	1,094	685	1,075	1,091	818
London	6,182	4,288	1,842	1,705	1,257	1,036
Leicester	35	47	41	1,300	2,420	2,030

This table is obtained from the Registrar General's returns.

† See Section III.

‡ Report of the medical officer of health for the borough of Salford, 1874, p. 25.

We observe at once that, as far as Leicester is concerned, there is no evidence as to especial epidemics of typhoid at this particular period—the third, or Autumn quarter of the year.

Dr. Buchanan* has recently considered this subject. He says :—

"Arranging, first, the several divisions of England in the order in which "fever" (the great bulk of which was enteric fever) was fatal in them during ten years; and putting on the same sheet the mortality of each division from diarrhœa no visible relation appears between the mortality of the several divisions by the one and the other disease.

Again, taking out from statistical returns districts with high or low fever rates, and examining the same districts as to their diarrhœa rates, little or no parallelism in the incidence of the two diseases can be found. Or, making a list of the twenty-five registration districts of England, that in 1851-60 had most fever; and another list of the twenty-five that in the same period suffered most from diarrhœa, only one name appears on both lists. The fever districts are seen to be essentially rural or small town districts, the diarrhœa districts to be large towns, most of them manufacturing towns."

It is perhaps hardly necessary to say that such statements as the foregoing, coming from so high an authority, are of the utmost value and importance.

During our inspection we saw 26 instances in which diarrhœa was prevalent in the house at the time, and 11 in which it was "next door." We observed the cases attentively; they were chiefly cases affecting infants. We could find none of the well-marked symptoms of Enteric fever—the clinical history and symptoms of the cases differed materially from those accompanying typhoid. If we had had opportunities for pathological observation, we should have been in

* "On some Directions for Scientific Work by Medical Officers of Health," by George Buchanan, M.D., president of the Society of Medical Officers of Health. (The inaugural address delivered at the first meeting of the Society for the present Session, 16th October, 1875).

a position, most likely, to state absolutely that which we suppose to be the case: that the two diseases are not allied, that they differ in origin, in distribution, in mode of attack, and in character generally.

If we are thus able to establish negative facts, some ground has been gained towards our knowledge of the nature of Epidemic diarrhœa or Summer disease. Whatever may be its true nature or the true pathology of the disease, one thing is certain, that more favorable conditions exist for its development and fatality in Leicester than elsewhere.

The subject of mortality from diarrhœa in relation to weather has until lately received but little attention from medical authorities and others.

Reference to Mr. Buchan's Paper.

In an able and interesting paper, read before the Scottish Meteorological Society, held at Edinburgh, on July 13th of this present year, and of which a report appears in "Nature" of August 5th, Mr. Alexander Buchan enters fully into this subject. His materials for enquiry were obtained from the Weekly Reports of the Registrars General for England and Scotland for the 10 years 1865-74. On reference to his Chart* two most important facts are to be observed, viz. —

I.—That the death-rate from infantile diarrhœa is found, as a rule, to rise proportionally with the increase of temperature.

II.—That Leicester, with regard to its rate of mortality (in this respect), is far ahead of all other large towns.

This latter fact is unfortunately only too well known. If our readers, however, will look at Mr. Buchan's Chart, they will see the exact position which Leicester holds in re-relation to other towns.

Temperature and Diarrhœal death rate Curves in Leicester.

The former of these two facts is no less evident. We have a confirmation of it in this last epidemic. By reference to Chart† it is seen that the mean temperature in

* See Chart in Appendix.

† See Appendix. For the temperature curve in this chart we are indebted to Mr. W. J. Harrison, Curator of the Museum.

Leicester, after some variation in July, gradually rose in August, until on the 16th it reached 71 degrees, its highest point. The death-rate reached its maximum about one week later, viz., on August 25th, on which day nine deaths occurred, with a mean temperature of 65 degrees.*

Having then advanced this proposition, we must review our position, and reconcile this fact of the simultaneous rise both of temperature and death-rate with the obvious fact, that, the death-rate does not rise or fall proportionally with the different temperatures of different localities or towns. Take an example: In London, the mean temperature is nearly two degrees higher than in Leicester,† and yet the diarrhœa rate in Leicester is 6 per thousand per annum for the third quarter, higher than in London.

Effects of Heat not constant.

Mr. Buchan says:

"At Leicester, the summer temperature does not exceed that of Bristol; but while the summer death-rate from diarrhœa at Bristol is 2.38, at Leicester it is 9.56; in other words it may be assumed that there are local peculiarities affecting the population of Leicester, the effect of which is to quadruple the death-rate from diarrhœa in that town as compared with Bristol. It is to these local conditions we must look for an explanation of the great differences in the death-rate of the different towns."

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* Dr. Buchanan, in the paper previously alluded to, quotes various sickness records, showing that fatal and also non-fatal diarrhœa is not epidemic before July, whatever may have been the heat of the weather; and he states further:

"Still the fact of there being a distinct difference between the operation of September heat, and July-August heat, in the production of diarrhœa, is a consideration, which, even as it stands, deserves further study."

Mr. Buchan points out that the deaths occur from diarrhœa in the period of heat plus moisture, or of heat combined with a low atmospheric humidity.

In June, the period of heat, there are but few deaths from this disease.

This combination of heat and moisture seems to have some peculiar relation to diarrhœa as epidemic in Leicester, which we shall refer to at greater length in Section III.

† See Registrar General's Quarterly Return, for quarter ending September, 1874. London, 60.6; Leicester, 58.8.

Here, then, lies the gist of the whole question. Are there local conditions on account of which Summer diarrhœa should be so excessively fatal in Leicester, and if so, what are they? The first of these questions we do not hesitate to answer in the affirmative. The second will be answered to some extent, at least satisfactorily, we hope, in the concluding section of this report.

We have already intimated that this diarrhœa with which we have to deal is one which occurs as a primary disease, and not one in which there is traceable intermediate disease, and further we have shown that this diarrhœa accompanies in varying proportions the high temperatures of Summer and Autumn. In this respect, then, it may be justly urged that the heat causes the diarrhœa; that is to say, that were there no Summer we should then have no infant diarrhœa—that is, "Summer disease." But we have a high temperature in the Summer and Autumn, and we have a diarrhœa, and one which is very fatal among infants.

Here follows the natural question: Does this heat operate more fatally in some towns and localities than in others? Or does it, being of much the same intensity in towns (as far as England is concerned), act in much the same way?

This question has already been answered. There must be a cause or causes in Leicester to favor the fatality of this Summer disease.

Retrospect.

It will be necessary now to look back upon the information we obtained during our inspection, and which is placed before our readers in Section I.

We have shown that the parents of the infants who died during the last Autumn were of mature age, with regard, at any rate, to powers of reproduction. That nearly 80 per cent. of the parents enjoy good health. In addition, we have remarked that the infants were those whose parents belonged to the so-called working-classes; and that of the mothers, 24.5 per cent. go out to work—or better still, that 75.4 per cent. are domestically employed.*

* In a recent report issued by Dr. Seaton, of Nottingham, for quarter ending September 30, 1875, there appears a table showing the proportion

We have given our opinion, also, that the "neglect of mothers," as a cause, is greatly exaggerated. It has been shown that the fatality of this summer disease is limited to infants of one year or under; that nearly 70 per cent. of them were born "healthy," that over 90 per cent. were nursed by mother or near relative; in fact, that there was every reason thus far why they should live, and not by their deaths make Leicester so painfully notorious.

Registration not accurate.

Of course, in Leicester as in other towns, deaths occur in infants from diarrhœa, and are returned as such, which more truly should be returned under the name of the constitutional disease which has determined the fatal symptom. Such cases all go to swell the general return, but are insignificant in number as compared with those cases in which diarrhœa is the disease itself, and which in Leicester finds for itself so favorable a nidus. At the risk of some repetition, it must be pointed out that it is this Summer disease—primary diarrhœa—attacking the previously healthy infant; and in nearly 50 per cent. of cases proving fatal in a week or under,* which requires the utmost attention.

The Specificity of the Disease.

During the inspection, we were much struck with the great similarity there seemed to be in a considerable number

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of women, over 20, domestically employed in eight of the large towns of England. With the exception of Nottingham, Leicester is seen, with Norwich, to have the lowest percentage, viz., 44 per cent. Dr. Seaton takes his returns from the Census of 1871, and he observes, "of course, among them are included many who are not mothers; but the figures serve to give an approximate estimate of the extent to which the above-mentioned cause, viz., maternal neglect, is in operation in different towns."

The diarrhœa rates of these towns show no connection with the number of women domestically employed according to the above estimate. (See table in appendix.)

It will not be forgotten that our per centage of women, "domestically employed," which nearly doubles the one above, is obtained from the results of our own inpection. With regard, then, to infantile diarrhœa in Leicester, and its relation to maternal neglect, the tables published by Dr. Seaton cannot possibly convey an approximate estimate. It should be stated that Dr. Seaton, in his Report, is drawing attention to infantile mortality generally, and not to the one disease, diarrhœa, only.

* See Section I., p. 10.

of cases, and especially among those in certain districts of the town, to which districts we shall hereafter refer.*

It occurred to us then, and we still think it to be the case, that this complaint as it exists in Leicester is one which should be classed among the so-called "Specific" diseases. It was the nature of the illness, the mode of attack, the distribution, the fatality, apparently limited by age, that led us to this opinion.

We do not mean to suggest, of course, that every case of diarahœa that was enquired into was of this "Specific" nature. Many cases were due to those constitutional and other causes to which we referred in the former part of this Section, and which cases occur in every town. At the same time we have a very large excess of infantile diarrhœa in Leicester, and we believe also a "Specific diarrhœa," which hitherto has not received recognition from medical authorities.

We propose to illustrate our Specific disease by giving briefly our notes of six fatal cases.

Series A. No. 104—

Case I.—*Infant* 11 *weeks.*—Father 27, strong, clerk; mother 30, strong, works at home; infant healthy born, ill 4 days, had the "frost," partially suckled; arrowroot, corn flour, and bottle. Cases

Series A. No. 120.

II.—*Infant* 6 *months.*—Father, 28, strong, musician; mother 26, strong, housewife, 2 children living; infant healthy born, ill 4 days, had the "frost," then diarrhœa, not suckled; Neave's food and bottle.

Series A. No. 41.

III.—*Infant* 7 *months.*—Father 38, strong, builder; mother 38, indifferent as to health, housewife, 4 children living; infant healthy born, taken suddenly ill, "inflammation of bowels," (statement of mother), died after 2 days, no teeth, was partially suckled; cow's milk, arrowroot.

Series A. No. 46.

IV.—*Infant* 5 *months.*—Father 27, strong, shoe finisher;

* See Section III.

mother 26, strong, housewife, 1 child living; infant born strong, suddenly attacked with diarrhœa, no teeth, suckled; arrowroot and corn flour. Father had diarrhœa at the same time that the infant died—a sharp attack lasting from 3 to 4 days.

Series B. No. 80.

V.—*Infant* 6 *weeks.*—Father 33, strong, factorywork; mother 32, strong, housewife, 3 healthy children living; infant born healthy, had the "frost," which "struck inwardly," ill for 3 or 4 days, wholly suckled.

Series B. No. 19.

VI.—*Infant* 8 *months.*—Father 29, strong, trimmer; mother 25, health indifferent, seamer at home, 3 living children; infant born healthy, "teething," ill 5 days, suckled; arrowroot.

Now these six cases taken from our tables are seen to be somewhat alike. The infants born healthy, of strong parents, well fed, die after three or four days' illness from diarrhœa which has attacked them suddenly. That these cases are typical of a large proportion of those occuring in Leicester, is readily seen when the reader refers to the tables in Section I.

We cannot give the percentage of these cases as compared with those returned as "diarrhœa," in which the diarrhœa in fact was but the fatal symptom, but it is quite evident that the excessive rate of diarrhœa in Leicester would disappear if there were none of these cases which we have ventured to term "specific."*

Mr. John Buck† says on this point, "Without denying the influence of weather and seasons, I am of the opinion

* Since these investigations—the result of which appears in the text—were made, Dr. Buchanan has given it as his opinion that, "infantile diarrhœa, and particularly the form of disease epidemic in the summer, may be a specific disease in the broad sense of the word specific."

Trousseau, more than any author with whom we are acquainted, treating of infantile diarrhœa, describes symptoms of the kind we met with; but he regards the disease as non-fatal, whereas the disease with which we are concerned is essentially fatal.

† "A Report on the Sanitary Condition of Leicester in 1851," by John Buck, Officer of Health. Page 11.

that this disorder is mainly produced by organic decomposition. Its victims will be found to be, exclusively, the very old and the very young—those who from inherent debility are more confined to the vicinity of their own dwellings, thus becoming, as it were, doubly liable to an endemic disorder; the manner of its seizure oftentimes being sudden, like a lightning stroke, and its speedy development (prolonged a few hours certainly beyond Asiatic cholera), appears to me more nearly to indicate the presence of an organic poison than any other source that could be devised as its probable origin."

We must now consider how it is that summer disease is not constant in its fatality. Could we suppose, for example, that all the healthy born infants of one year or under, in Leicester, were placed under the same circumstances with regard to nursing, diet, medical attendance, and so on—then heat, being itself a condition exercising an equal influence, that is, acting with equal intensity throughout Leicester, an area of 3,000 acres, could surely have but one effect—if it kills one infant, why not all?

Reference to Dr. Crane's Report.

Dr. Crane observes :* "The mode in which heat acts in predisposing to the occurrence of diarrhœa, and in keeping it up in the weak, is, I conceive, by inducing a relaxation and atony of the whole system, and of the digestive organs in particular, so that the stomach is unable to digest certain articles of food, which at other times, in a lower temperature, would be digested without difficulty, that these articles of food passing from the stomach in an undigested state, set up irritation in the mucous membrane of the bowels, and consequent diarrhœa (an effort of nature to expel them)."

This we think to be a very rational explanation as far as it goes, of the direct action of heat. Dr. Crane observes further, that the greater mortality in some towns than in others must make us take into consideration two circumstances, viz.—the situation of the town, and the vigour of its infantile inhabitants.

Already we have directed your attention to the latter of

* Report, 1868.

these two conditions as far as concerns this present enquiry. The former, no less important, has yet to be considered.

But to return, the hypothesis advanced above (page 27) is practically untenable. The infants cannot be supposed to be *all* under the same circumstances. How then may and do these circumstances differ? What circumstances offer the least resistance to this Summer disease, and what circumstances surrounding an infant tend to shield it most effectually from this complaint, which has been regarded as essentially a mild disease, and one readily amenable to treatment?

What other factors may there be acted upon by heat, or acting in conjunction with it?

It is evident that there must be other factors.

It has been shown, for instance, that all these infants who died were those whose parents belonged to the so-called working classes; so it would seem that those infants whose parents were of the middle or upper classes, did not suffer equally with those of the lower. They suffer to some extent of course, but the disease is not fatal among them.

It is not easy to imagine that heat in itself could have any but the same effect upon the system of an infant born of well-to-do parents and one born of poorer parents.

Since it is known that the fatal cases mainly occur in families of the artizan and labouring classes,* some people assert that this diarrhœa must be caused by overcrowding, neglect, and insanitary conditions generally, which are only too often erroneously assumed to exist amongst these classes.

This explanation seems so rational, that many people are readily satisfied that it must be so; but when we come to point out that this summer disease is not so fatal among the very poor, is almost unknown in many of the most crowded courts in the town, and that, as a rule, general insanitary conditions do not exist,† then we say the explanation is not so easy, and that there are other factors at work, other peculiarities affecting the working population, or the town in which they live.

* See Dr. Crane's report for 1871, pages 13 and 14. There is here a list of the parents of the 220 children that died from diarrhœa in this year, giving their occupations, our list is much the same.

† See Section III.

SECTION III.

The town of Leicester* is mainly situated on a bed of clay, lying on the new red sandstone. It is surrounded by the Dane, Spinney, and Forest Hills, leaving exposed only one portion—the north-east. The old part of the town, which contains districts having the narrowest streets and most densely populated neighbourhoods, stands mostly upon a bed of gravel, and is on the western side. The town is surrounded by water on three sides; by the River Soar on the western and northern, and on the eastern by the Willow Brook, a tributary of the Soar. The Soar is headed up against the town by four mills; this militates in various ways against the health of its inhabitants, by leading to the stagnation of sewage and subsoil water, and these faults appear to attain their intensity towards the angle formed by the junction of the Willow Brook with the Soar. Description of Leicester.

Some part of the town, that part skirting the river, is situated upon an alluvial deposit, which varies considerably in its layers and depth. Of this deposit the following table may be taken as a type— Alluvial Deposit.

Alluvial Deposit	1	Soil
	2	Peat
	3	Clay
	4	Gravel
	5	Clay
	6	Marl

Some parts of this deposit are tolerably porous,† others almost impermeable; but it is noticed that this soil recovers itself in two or three days from the effects of a flood. Not so, however, with the low-lying clay of the eastern district; this takes weeks, and perhaps more accurately speaking, months, to clear itself of surplus subsoil water.

* See Map. For this Map we are indebted to Mr. Stephens.

† Professor Pettenkoffer, who has worked at the question of subsoil drainage in Munich, says that in Munich epidemic cholera, as such, was

We had many instances of the dampness of the subsoil in the north eastern district, and also in some of the low-lying parts in the north, as in Lyttleton Street.

Illustration of Sub-soil Saturation.

A good instance of this dampness occurred in Chester Street, Russell Square, at the Dispensary, of which the following particulars were given to us by Mr. Dalrymple.

"It was found necessary, soon after the building was completed, in February last, to make some provision for the waste water from the boiler, which found its way into the cellar.

A bricked pit was made 6 or 8 feet away from the outside cellar wall, and connected with the cellar by means of a pipe. This pit was 12 feet deep, and 4 feet 6 inches in diameter, and as the depth of the cellar floor was 6 feet from the surface, it was supposed that the waste water, in this way, would drain from the cellar into the pit, and so leave the cellar dry.

It is found, however, that this pit is never empty; that in fact it drains, or helps to drain, the soil of the neighbourhood.

After the rains, this last Summer, a depth of 5 or 6 feet of water was in the cellar, and then it could not be kept down by pumping, for it soon rose to the same level again." In this district, then, the 'line of saturation' must be within a few inches of the surface.

In Carley street, Birstall street, and Emerald street, the soil was very damp at the time the sewers were opened for our inspection. Indeed, it is difficult to imagine how the sub-soil in the low-lying parts of the town could be otherwise, when we remember the way in which the water in the river is dammed up against the town by the mills; and how

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confined to the porous soil, while the disease was absent as an epidemic on the clay soil.—"Cholera," by Pettenkoffer, translated by Hime, 1875. Page 40.

This bears on the subject we are discussing, for we know that cholera did not attack Leicester at all severely, in fact it did not become epidemic. (See Section II., p. 19.)

Leicester is mainly situated on a damp alluvial, and clay soil; a small portion only being on gravel. It also bears out what we have asserted in Section II., viz., that this infantile diarrhœa in Leicester has nothing to do with cholera.

the sewage is liable to be kept back in consequence of the imperfect outfall.* It has been found that sub-soil water does not necessarily drain horizontally to a river, but generally slopes according to the contour of the ground through which it permeates, and it has also been noticed that the rise and fall of a river will affect the sub-soil drainage more than half a mile away.†

Is Leicester, as a town, specially unhealthy? It is impossible to give a categorical answer to this question; but we propose to examine some statistics of Leicester mortality during the year 1874, as given by the Registrar General and Dr. Crane, bearing on this subject.‡

Statistics relating to Mortality in 1874.

Statisticians have again and again tried to find out some one death-rate which would give an idea of the health of a town, and so various rates have been suggested, notably the following:

Tests.

I.—A general death-rate per 1000 per annum at all ages from all causes. In Leicester there are some special reasons why this should not give us a fair idea of the actual state of the town.

Leicester is a town which is increasing largely from the influx of healthy young adults seeking employment. This immigration must necessarily disturb the death-rate.

Again in Leicester there is a fatal disease occurring every year at the same time which spends its force on infants under one year of age. This also must seriously affect the above death-rate.

II.—The death-rate of children. This test would be invalidated as regards Leicester by the high birth-rate. A high birth-rate necessarily entails a high children's death-rate, because in any community it is found that the first quinquennium of life is an extremely fatal period, in fact

* From Mr. Stephens' Report (to be alluded to further on) it appears that the pumping powers at the sewage works are small and limited.

† "Practical Hygiene," by Dr. Parkes, fourth edition, page 306.

‡ The Registrar General's annual summary, page 11, in this eighteen large towns are compared, as regards their death rates, birth rates, average population, temperature, &c., &c.

Dr. Crane's report for 1874.

twelve times the mean mortality of the succeeding twelve quinquennia.*

III.—The percentage to total deaths from the seven principal zymotic diseases during the year.†

This percentage fluctuates so from year to year in consequence of the presence or absence of epidemics, as to render it of little use unless long periods, such as ten years be taken.

IV.—The percentage of deaths of persons aged 60 years and upwards to total deaths.

This test is necessarily invalidated as regards Leicester by the high infantile death-rate which exists in the town, and also by the number of immigrants who come into the town.

The four Tests considered together.

An approximate idea may be formed by taking these four tests together. This we propose to do.

Table I.

On reference to the Tables in the Appendix, and also to the Mortality Chart, it will be seen that Leicester is slightly below the average of the 18 large towns as regards the annual death-rate per 1000 from all causes, at all ages, being 24.1. Liverpool is highest with 32 ; Portsmouth lowest with 20 ; the mean being 25.

Table II.

Taking the percentage of deaths from the seven zymotic diseases to fatal deaths, Leicester (notwithstanding the fatal diarrhœa) is below the average—being 16. Birmingham is highest with 27.4 ; Norwich lowest, 8.7 ; the mean is 17.9.

Table III.

Taking the percentage of deaths of persons aged 60 years and upwards to total deaths, Leicester is just above the average, being 20 ; Norwich 32 ; Salford 14.3 ; the mean is 19.6.

Table V.

Taking the percentage of deaths of infants under one year to total deaths, Leicester stands unenviably at the head

* "In a vigorous, young population, the births being above the average, the infantile death rate will also be excessive, even under the best sanitary conditions."—"Some Fallacies of Statistics," by H. W. Rumsey, M.D., F.R.S. Page 187.

† The seven principal zymotic diseases are smallpox, measles, scarlet fever, diphtheria, whooping cough, diarrhœa, fever including typhus, typhoid, and simple or continued fever.

of the list—36.5; the next town is Sheffield, 29.2—a difference of 7.3; Portsmouth is lowest, 23.9; the mean is 26.3.

Taking the annual death-rate from diarrhœa per 1000 per annum during the third quarter of 1874, Leicester again heads the list with 8.5; Bristol is 1.8; the mean 3.8.* Table VI.

In all infantile death-rates, Leicester either heads the list or is second. If we take the per centage of deaths under one year of age to births registered, Liverpool heads the list with 23.3; Leicester is 21.5; Portsmouth is lowest, 15.1; the mean is 17.4. Table VIII.

If we take the infantile death rates and compare them with the birth rates it will be found that there is a connection between them. Leicester has a birth rate above the average; thus Leicester is 41; the mean is 37.2; Salford heads the list with 44.2; Norwich has the lowest, 31.7. Now, on contrasting these with the infantile death rates of these various towns, Leicester heads the list with 36.5; Norwich is at the bottom with 23.8; Salford is above the mean (26.3), for it is 28.2. Norwich has a low birth rate and infantile death rate; Leicester has the converse. So we see Leicester has an excessively high infantile death rate whichever way we compare the deaths. Tables IV. & V.

The first three tables and tests undoubtedly shew that Leicester is not an unhealthy town as regards adult population. This can be seen on reference to the mortality chart.

Notwithstanding its high infantile and diarrhœal rates, Leicester has a death rate from all causes at all ages per 1000 per annum below the mean of the 18 large towns of England.

The same may be said with regard to the test of the rate of the mortality from the seven principal zymotic diseases. That a large proportion of people die aged 60 years and

* This table is taken from the Registrar General's quarterly report for the third quarter of 1874, and it is a very interesting one, for some manufacturing towns noted for their employment of female labour have extremely small rates, *e.g.*, Halifax, Huddersfield. Again in some towns the rate appears to be decreasing, Yarmouth, Shrewsbury, Leeds. In other towns it appears to be increasing, Sunderland, Worcester.

upwards, as proved by table III, is a fact favourable to Leicester.

In short, if Leicester could reduce the infantile death rate to the mean of the other large towns, it would stand in a very favorable position as regards any or all of the usual tests of the healthiness of a town ; it would be regarded as a healthy manufacturing town.

From the foregoing tests it would seem that Leicester is not specially unhealthy as regards adults. Supposing the town were in a general insanitary condition, could the above rates exist as regards the adult population? We think not.*

These facts necessarily shew on the other hand that it is this infantile diarrhœa, or specific diarrhœa as we prefer to term it, which gains for Leicester its reputation for general unwholesomeness.

Water Supply.

It has been suggested by many people that the water supply of the town had much to do with the excessive diarrhœa. Two theories have been advanced on this subject :

I.—That the water supplied by the Waterworks Company was impure, and so caused the diarrhœa :

II.—That the well water in the town was, as a rule, polluted with sewage, and, consequently, liable to affect the infants.

As regards the first theory, it is untenable for many reasons, of which the following are the most important.

The excessive fatality from infantile diarrhœa, though not quite so pronounced, was nearly at the same rate before the Waterworks Company was established as it is now.†

* The death rates of children have been too often quoted, or misquoted, as tests of local sanitary conditions, without a full comprehension of their meaning and value. Even were the census perfect, and the registration of births compulsory and complete, the proportion of deaths during early infancy must be a most inadequate exponent of the healthiness of any community, depending as it does mainly on the number of births, or rather, on the number of living infants.—"Some Fallacies of Statistics," by H. W. Rumsey, M.D., F.R.S. Page 187.

† See reports of Registrar General, and of Mr. John Buck, formerly Officer of Health for the borough of Leicester.

By Mr. Buck's report for 1851 (p. 10), we find that there were 121

The infantile death-rate from diarrhœa has not increased step by step with the increased use of the Waterworks Company's water.

The majority of the houses inhabited by the wealthier classes are supplied with Waterworks water, and yet not a single fatal case of diarrhœa has occurred amongst this portion of the population during the present year.

Children of the age of one year or under, drink but little water—milk forming their chief liquid food—they consequently do not encounter so many chances of being affected by impure water as children over that age who are weaned. Children over one year of age do not in Leicester die from diarrhœa, at least there are very few comparatively.

It is said, however, that the mothers drink the germs of this fatal disease and transmit them to their infants in the process of suckling! Such a method of transmission of disease is unknown to medical science.*

We do not deny that impure water is a cause of diarrhœa. It very often is, and when it is the adult population suffers more than the infantile. Generally speaking there is a concurrent amount of typhoid fever.

We do not find that the adult population is appreciably affected with diarrhœa, and as we have stated in Section II., page 19, typhoid fever seems not to have any connection with this infantile diarrhœa.

As regards the second theory that well water is the cause, we point out that notwithstanding the number of wells being decreased year by year, the death rate from diarrhœa has not decreased.

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deaths from diarrhœa in the third quarter of that year. This would give a rate of eight per thousand per annum, taking the population for that date at 60,000. This is certainly very remarkable that the death rate from diarrhœa should have been, 24 years ago, nearly the same in Leicester as it was last year!

The Waterworks Company's water was first used in December, 1853.

* The transmission of disease from parent to infant is not infrequently observed, (*e.g.*, as in syphilis); this, however, is a process, physiologically and pathologically considered, that could bear no resemblance to the hypothetical one mentioned in the text.

Examination of Sewers.

We examined, towards the end of August, sewers in six streets, viz., Carley street, Friday street, Britannia street, Birstall street, Emerald street, Catesby street, and Oxford street. With the exception of one street, Britannia street, we found no evidence of any interruption to the sewage current. St. Margaret's ditch, in Britannia street, had about six inches of silt, a very slow stream, and was extremely foul. This sewer was opened in two places; the condition in both was much the same.

There appear to be two main sewers for the town, the one to drain to Western, the other the Eastern district. They both must labour under peculiar difficulties from the nature of their outfall, more especially in rainy weather, which latter fact is well explained by the following extract from Mr. Stephen's report.* Alluding to rain water, he says :—

Reference to Mr. Stephen's Report

"One inch on the 2,000 acres of town area would yield 45,360,000 gallons; about one-eighth of that quantity finds its way into the deep sewers in an hour or two, which, added to the ordinary sewage, gives a quantity nearly equal to the full power of the engines for 24 hours. The engines becoming overpowered, the storm-water sluice has to be opened; but this does not produce a free outfall, because it opens into the tail water of the Belgrave mill, the surface of which is nine feet above the invert of the main sewer, so that the water has to rise to that height before it can get away. Not only is this the case, but to produce a current the water

Mr. Stephen's Report.

in the sewers in those parts of the town distant from the works has to rise considerably, which causes the backing up into the basements, and this lasts for days, nay, weeks together; nor is this the only evil arising from this circumstance, for the water in the sewers being held back by the wall of water in the Belgrave mill tail, the flow is retarded, causing obstructions by deposit, which has to be periodically removed."

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* Report of the Borough Surveyor for Leicester on the means for preventing the flooding of basements by storm waters, and for the reduction of the surface floods. 1872. Page 4.

During our inspection we noticed in the Eastern district of the town, and particularly in streets lying between Belgrave gate and Humberstone road, many irregularities of paving, showing where the sewers had been lately opened, and consequently showing the necessity which had recently existed for their being flushed. Carley Street, in fact, was pre-eminent in this respect, it seemed as if the whole street had at one time and another been taken up for this purpose. It is obvious, then, that the soil in this neighbourhood cannot be drained thoroughly either of its sewage, or of its subsoil water. With regard to the Western district, these conditions must exist, though to a less extent, inasmuch as the main sewer of this district is surrounded by a soil of a comparatively porous nature, whereas the sewer in the Eastern district is surrounded by soil of an extremely retentive nature.

We now direct attention to the distribution of the disease in relation to the varying heights of the town, and the soils on which it is built.

Reference to Map.

The figures on the map denote the heights above the canal in the Abbey Meadow, but as the river is headed up to the extent of 14 feet by the three mills in the town, these figures must in all cases be taken in conjunction with the falls of the various mills, if it is desired to ascertain the height of a locality above the river level.

For instance, in Braunstone Gate 13 is the figure given, but as the two mills below this give a fall of 10 feet 6 inches, this fall must be deducted from 13, giving 3 feet 6 inches as the height above the level of the river.

It may be noticed that while Braunstone Gate is low as regards surface water, it is not so as regards the sewers.

In the North-eastern district, the houses labour under the disadvantage, not only of being situated for the most part on a retentive low-lying flat clay which cannot easily recover itself from surplus subsoil water, but also of being near the outfall of the main sewer, which is liable to be blocked up by excess of fluid on a moderate rainfall.*

* See report of Borough Surveyor. (Antea).

The backing up of sewage affects the sewers most in that part of the town nearest the outfall, if the exit of a sewer 9 feet below the water level of the Belgrave Mill tail, can so be termed.

Sand.

Beds of sand are seen on reference to the map to be situated here and there.

The largest is towards the North-east, and is divided almost equally into two parts, as it were, by Belgrave Gate. The drainage of these areas of sand must be regulated by the nature and contour of the soil surrounding them. It is not so much the soil itself, as the conditions to which it is subjected, which, broadly speaking, determine its drainage.

We take it that, with regard to the drainage both of subsoil water, and of sewage, this bed of fine sand labours under much the same difficulties as does the clay, with which it is surrounded on three sides.

Generally speaking the distribution of the disease is determined by the course of the river. The higher parts of the town have but little. The land of the low-lying parts of the North-eastern district of the town, where the concentration of the disease is most marked, consists as just shewn of clay, of a bed of fine sand, and also to some extent of artificial or "made ground."

In the Northern and North-western districts the houses are built upon gravel, (the old part of the town) and here the deaths are scattered as compared with those on the clay, and their specificity is not so marked. So in fact, we have in Leicester low-lying districts, which are to a great extent populated by the working classes.* To the East the people live on clay, and to a small extent on fine sand; to the West on gravel and alluvial deposit; and the deaths bear the proportion of about two to one in the former as compared with the latter.

If it could be shewn, that the density of the population was twice as great in the low-lying clay district, as it is in the low-lying gravel and alluvial district, this would go for nothing; but we shall point out that this is not the case.

* The wealthier classes, for the most part, live in the higher parts of the Town.

In this low-lying North-eastern district there are considerable areas of so-called "made ground."

It is necessary to direct your attention to this subject.

On reference to the map it is seen that certain areas are marked where clay, gravel, or sand has been removed, and then filled up so that houses could be built upon them. Made Ground.

This process has gone on for many years in various parts of the town, and is going on now. A large clay pit, situated between the Spinney Hills and Maynard Street, is now being filled up to constitute what is called "made ground." We were induced to visit and examine the nature of the ground and this process of filling up.

We observed here the system in its entirety. At one end clay was being taken out for the purpose of brick making; in the centre the pit was being filled in with various materials, and at the other end, on this recently made artificial ground, houses were being built.

The material which we saw being deposited in place of clay that had been removed, consisted mainly of ash-bin refuse.

We take from our notes the following examples:—

Specimen I.—Cinders, cabbage, which smelt abominably, apple parings, leather in strips, potatoe parings, remains of crockery. Specimens

Specimen II.—Cinders, cabbage, periwinkle shells, sardine tins, celery, and bean pods.

Specimen III.—Straw, beans, bones, quantity of animal remains, broken crockery, cotton waste.

Specimen IV.—One heap, about six yards square, specially foul; consisting of wet ash-bin refuse, rabbit skins all alive with maggots, cabbage, and other vegetable refuse, lemons, ropes, turnips.

These could be repeated.

One day we saw the foundations (if they can be so termed) being made for houses on some of this "made ground," and we saw the men digging out material, such as we have just described, only a few inches from the surface.

A more horrible soil for houses to be built upon can

hardly be imagined; more particularly if the clay pits should happen to be situated where they cannot be drained of their subsoil water.*

Dr. Parkes and Dr. Sanderson who investigated the relation of "made ground" to disease in Liverpool in 1871,† came to the following conclusions:—

"I.—No excavation should be used for the reception of cinder refuse unless it is efficiently drained. This appears to us to be of special importance in relation to the filling up of brickfields. It is well known that the whole of the surface of clay is never removed, and there is always sufficient to form an impermeable basin in which, in the absence of drainage, water constantly collects. We hold it to be of the greatest importance for the rapid decomposition of whatever offensive material may exist in the "cinder," that it should be able to become dry. The only way in which this can be promoted or secured is by *efficient subsoil drainage*‡

II.—As the vegetable and animal matter contained in the cinder refuse decays and disappears in about three years, and is virtually innocuous before that time, we recommend that places filled up with cinder refuse shall not be built upon for at least two years from the date of the last deposit."

That it is prejudicial for the infant population to live in houses built on this artificial ground has been pointed out by Mr. Crossley of this town|| It is, therefore, no new idea, but one which receives confirmation from our investigations.

* The Inspector tells us that at one time the people in the neighbourhood complained so much of the smells from the refuse put into one of these pits, (Waring street), that he was compelled to have some of it removed.

† Borough of Liverpool. Reports of Dr. Parkes and Dr. Sanderson on the sanitary condition of Liverpool. Page 15.

‡ The italics are our own.

|| "Handbook of Hygiene," by Dr. Wilson, page 186:—

"In towns a great evil sometimes arises from building on rubbish containing vegetable matter which has been used to fill up the excavations made in brick making. Thus Mr. Crossley reports that the high rate of mortality in Leicester during the autumnal months was chiefly due to an annual visitation of infantile diarrhœa, which prevailed in parts of the town built on such refuse. And he distinctly attributes the disease to this cause."

It is to be observed that it is the vicinity of the made ground, as well as the ground itself, which is unhealthy. Its unhealthiness is dependent upon, as observed by Drs. Parkes and Sanderson :

I.—The length of time that has elapsed since the pit was filled up.

II.—Its drainage. We see in the map that towards the Central and Southern districts of the town there are areas showing where clay pits have been filled up with cinder refuse, and built upon ; but these areas are not now unhealthy, from the fact that many years have elapsed since the houses were built, and also that they are on high ground, and consequently well drained.

During our inspection we visited a house in which there were some cases of fever. The house which was built on some of this made ground, was to all external appearances a house in which fever should not have occurred ; but on enquiry into the water supply we found that the inhabitants had derived their water from a well which had been sunk into the "made ground." Well sunk in Made Ground.

The quality of the water thus obtained may be judged from the following account : "We only used it a few times, for when we boiled it, it stunk the house out."

Leicester stands out pre-eminently in comparison with other large towns in respect of the width of its streets, the absence of cellar dwellings, the comparative freedom from crowded courts, and houses built back to back. As to Streets and Houses.

It is only in the oldest part of the town, which is chiefly on the Western side, that narrow streets and courts are to be found, and in these crowded parts, curiously enough, this specific diarrhœa is not found. The cases that occur here are mostly cases of diarrhœa from constitutional and other causes (Section II) ; that is to say, the sort of diarrhœa which is naturally expected in an infant population. We hardly found one case of specific diarrhœa in these oldest neighbourhoods.*

* The oldest part of the town is on the Western side.
The population on the Eastern side is as seven compared to four on the

In the new parts of the town, more especially in the Eastern district, but also in the Western, the houses which are occupied by the working classes would compare favorably with those of any town. They are roomy houses, which have yards or gardens, and are built in wide streets; are supplied with Waterworks water, the house drainage is conducted to the sewers by blue brick gutters. the closet arrangements are good, in fact to all appearance they are the very houses where infants should not die. A type of them is to be found in Lyttleton street in the North, in Birstall street in the East, and Catesby street in the West.

It is in these very houses where we found case after case which we have described in Section II as a diarrhœa of a specific nature. This, as we have pointed out, differs materially from that diarrhœa which for the most part exists in the older and more crowded portions of the town as in the Jewry Wall street district. In this, the older portion of the town, the houses can hardly be said to be drained of their house slops, &c., for the sewage stands in badly-paved pebble gutters, sinking into the earth, fouling the water, and polluting the air, instead of, as in the newly-built dwellings, running along properly constructed gutters or in drains to the public sewers.

Relation to Density of Population

We now show that this diarrhœa is not most prevalent where the population is most dense. We have determined the population of various streets by multiplying the number of houses by the estimated population for each house,† and

western. By reference to the tables in Section I., and comparing Series A with Series B, we find, by taking *all* fatal cases that—

I.—The absolute incidence of the disease (population equal) is rather greater in the Eastern district—in other words, the deaths in Series A are 143, in Series B, 73—if they bore equal proportions to the population, the deaths in Series A should be 127.

II.—Rapidity of death rather more commonly observed in East than in West.

III.—Children dying had been healthy born in East district rather more commonly than in West.

IV.—Suckling, wholly or partially, was rather more common in East than in West, in fatal cases.

† In the report of Dr. Crane for 1874, 4.79 inhabitants are given for each house, we have taken 5.

then have divided the area* by the population, thus giving the number of square yards to each person within the area taken. By this means we find the population to be most dense in Jewry Wall street and in Upper Charles street, in which districts by our method of calculation each person has 11 square yards.

In these two districts, dense as they are, this fatal diarrhœa hardly exists at all. In Birstall street district, in which each person has 28 square yards, it will be seen on reference to the map that the diarrhœa rate is above the normal.

In York street district (Welford road), each person has an area of 20 square yards; in Jarrom street district, 23 square yards; in Wheat street district, 22 square yards. This proves that the diarrhœa death-rate is not regulated by the density of the population.

It may be here remarked that, as a rule, the denser the population the poorer it is. We know this to be the case as regards the population of Leicester, therefore it is seen that this disease does not follow upon poverty any more than it does upon density.

On reference to the map it will be seen that the fatal cases are most concentrated in the low-lying portions of the North-east district. Deaths are marked out in the new streets in the East, North, and West; some parts of the town either escaping altogether or having what may be considered the usual number of deaths for a manufacturing town. These districts are for example those around Charles street, Rutland street, High street, Newarke street, &c.

In a report by Mr. J. Buck, in the year 1852, there is a map on which are marked the fatal cases of diarrhœa which occurred in the year 1851. The distribution of the disease was the same then as it is now, with the exception, of course, of the newly added houses. The higher parts of the town escaped then as they do now.

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* "Area," that is, the house area plus the street area. (For this information as to area and number of houses we are indebted to Mr. Stephens).

Retrospect.

Now we have described the various conditions we have met with in the town as to drainage, saturation of sub-soil, "made ground," density of population and houses. We have shown, moreover, that the specific typical cases are not dependent on the smallness of the house, nor on the poverty of its inhabitants. They are to be found in houses of a good stamp as regards household sanitary arrangements,* and amongst the families of the working classes—not the very poor—but of the well-to-do artizan class.

We have shown that that part of the town in which the disease we term "Specific" is most prevalent, viz., the North-eastern, is the part in which we have the following conditions, the first three of them showing a concentration of evils:

I.—Sub-soil saturated.

II.—Liability to stagnation of sewage.

III.—A greater proportion of undrained "made ground" than elsewhere.

IV.—Houses for the most part of good sanitary arrangement.

V.—Population not more dense and not poorer than in other parts of the town.

VI.—Heat the same here as in the rest of the town.

Heat in relation to Soil.

From the foregoing conditions, does it not seem that heat has a different action in this part of the town—that there is something favorable in the nature and conditions of the soil for the production of disease? We have shown already that this specific form of diarrhœa does not occur in those dwellings of the poor as in the Jewry Wall street district, which are built upon dry-drained soil—the heat must be just the same.

Thus it seems to us that heat, in conjunction with a water-logged soil, forms a favorable condition for the production of epidemic diarrhœa in Leicester.

The effect of heat plus moisture is well seen in the deaths about Lyttleton street in the North, where almost

* These houses obtain a rent of 5s. a week, and in some instances more.

all the cases were of a specific nature. The houses were exactly the same in their arrangements as those we have described in Birstall street, and the population is not a poor one. The soil, however, was exceedingly damp when we visited the neighborhood.

We cannot do better here than quote in extenso the description given by Dr. Parkes* of diseases connected with moisture and ground water: Reference to Dr. Parkes.

"Dampness of soil may presumably affect health in two ways: 1st.—By the effect of the water, per se, causing a cold soil, a misty air, and a tendency in persons living on such a soil to catarrhs and rheumatism; and 2nd—*By aiding the evolution of organic emanations.* The decomposition which goes on in a soil is owing to four factors, viz., The presence of decomposable organic matters—animal or vegetable—heat, air, and moisture. These emanations are at present known only by their effects; they may be mere chemical agencies, but more probably they are low forms of life which grow and propagate in these conditions; at any rate moisture appears to be an essential element in their production." †

It seems to us that this specific diarrhœa with which we have to deal is a disease caused by organic emanations; in other words, by an organic poison. Specific Diarrhœa, an Organic Disease.

The clinical characteristics of the cases point to such a disease, as also do the distribution, the period of production, and the fatality. From this point of view, then, it is seen how heat regulates, as it were, the intensity of the poison. Heat by itself, or heat acting on a healthy soil, is not baneful; but when it acts upon a soil drained neither of its subsoil water, nor of its sewage, then it becomes a deadly factor.

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* It is a noticeable fact that there are three or four cases, marked in the map, in the neighbourhood of Catesby street (in the Western district) which is just on the low lying edge of the clay, near the alluvial bed of the river.

There is said to be great difficulty in draining the subsoil water of this street, but we have no positive information on the subject.

† "Practical Hygiene," by Dr. Parkes, fourth edition, page 306. The italics are our own.

Summary :—

I.—That Leicester is not an unhealthy town, as regards the adult population.

II.—That its death-rate is unusually dependent on the infant mortality, and is regulated by it.

III.—That the excessive rate of infantile mortality is mainly due to a "specific diarrhœa," which prevails in the autumn quarter of the year, and is eminently fatal.

IV.—That such conditions as—

1.—Early ages of parents.

2.—Debility of parents.

3.—Maternal neglect.

4.—Debility of infants.

5.—Non suckling.

6.—Opium poisoning,

exist in the town, just as in other manufacturing towns, but that they have no appreciable effect in the main question at issue.

V.—That the houses in which the fatal cases occur are not in themselves insanitary, as regards—

1.—Size and number of rooms.

2.—Water supply.

3.—Ventilation and space.

4.—House drainage.

5.—Closet accommodation.*

VI.—That this specific diarrhœa is not diffused equally throughout the town.

VII.—That the disease is most prevalent where the following conditions exist :—

1.—Soil water-logged

2.—Sewers liable to be blocked up.

3.—Undrained "made ground."

VIII.—That the disease is less prevalent where the foregoing conditions exist to a less extent.

IX.—That the disease is almost absent in those parts of the town where these conditions do not exist.

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* See Section I.

SUGGESTIONS AS TO THE MITIGATION OF THE DISEASE.

I.—That the subsoil should be efficiently drained of its superfluous water.

II.—That a free outfall should be found for the sewers of the town.

III.—That clay-pits or other excavations should not be filled up with filthy ash-bin refuse and then built upon.

W. ELGAR BUCK.

GEORGE COOPER FRANKLIN.

APPENDIX.

TABLE I.

Annual rate of Mortality per 1000 for 1874, at all ages, from all causes ; mean 25.

In 18 towns.

Liverpool ...	32.0	Hull... ...	25.5
Manchester ...	30.4	Nottingham..	24.8
Oldham ..	29.7	Leicester ...	24.1
Salford ...	29.6	Wolverhampton	23.9
Newcastle on Tyne...	29.2	Norwich ...	23.5
Leeds ...	28.7	Sunderland ...	23.4
Bradford ...	27.0	Bristol ...	22.7
Sheffield ..	26.9	London ...	22.5
Birmingham...	26.8	Portsmouth ...	20.4

TABLE II.

Per-centage to total deaths of deaths from seven zymotic diseases in 1874 ; mean 17.9—small-pox, scarlet fever, diptheria, whooping cough, fever,* diarrhœa, measles.

Birmingham	27.4	Manchester ...	18.0
Liverpool ...	26.1	Portsmouth ...	17.9
Sheffield ...	22.3	Wolverhampton	16.2
Leeds ...	22.0	Leicester ...	16.0
Salford ...	22.0	Oldham ...	15.6
Hull ...	20.7	London ...	14.7
Bradford ...	20.3	Nottingham...	13.3
Sunderland ...	19.1	Bristol ...	9.4
Newcastle ...	18.8	Norwich ...	8.7

* Typhus, typhoid, and simple continued fever are included.

TABLE III.

Per-centage to total deaths of deaths of persons aged 60 years and upwards in 1874; mean in 18 towns, 19.6.

Norwich	32.0	Sunderland	18.5
Bristol	25.0	Newcastle-on-Tyne	16.9
Nottingham	24.1	Oldham	16.8
Portsmouth	21.9	Salford	16.3
London	21.6	Bradford	15 8
Wolverhampton	20.1	Manchester	15.6
Leicester	20.0	Sheffield	15.0
Hull	20.0	Birmingham	15.0
Liverpool	19.1	Leeds	15.0

TABLE. IV.

Birth-rate per 1000 per annum for 1874; mean, 37.2.

Salford	44.2	Bradford	40.0
Sheffield	41.6	Wolverhampton	39.8
Leeds	41.5	Manchester	39.2
Birmingham	41.3	Liverpool	38.7
Oldham	41.2	Bristol	36.4
Leicester	41.0	London	35.0
Hull	40.9	Nottingham	35 2
Newcastle-upon-Tyne	40.9	Portsmouth	31.8
Sunderland	40.8	Norwich	31.7

TABLE V.

Per-centage to total deaths of deaths of infants under one year of age for 1874; mean, 29.3 in 18 towns.

Leicester	36.5	Nottingham	27.7
Sheffield	29.2	Hull	27 6
Sunderland	29.0	Newcastle on-Tyne	27.6
Leeds	28.9	Oldham	26.3
Liverpool	28.4	Manchester	25.4
Salford	28.2	London	24.6
Wolverhampton	28.2	Bristol	24.5
Bradford	28.1	Norwich	23.8
Birmingham	27.7	Portsmouth	23.6

TABLE VI.

Annual death-rate from diarrhœa per 1000 during the third quarter in 1874 ; mean, 3.8.

Leicester ..	... 8.5	Sunderland ...	.. 5.0
Salford ...	... 6.7	Newcastle ..	... 4.7
Sheffield ...	... 5.9	Wolverhamption	... 4.3
Manchester ...	... 5.8	Bradford ...	... 3.9
Leeds... ...	... 5.7	Norwich ...	... 3.8
Liverpool ...	... 5.4	Portsmouth ...	... 2.8
Birmingham ...	... 5.3	London ...	... 2.7
Nottingham ...	... 5.2	Oldham ...	... 2.7
Hull	... 5.0	Bristol ...	... 1.8

TABLE VII.

Mean temperature in third quarter of 1874 ; mean, 58.1

London ...	... 60.6	Nottingham...	... 58.4
Sunderland ...	... 60.0	Sheffield ...	... 58.2
Birmingham...	... 58.8	Leeds ...	... 58.1
Leicester ...	... 58.8	Bradford ...	... 57.6
Wolverhampton	... 58.7	Liverpool ...	... 57.6
Manchester ...	... 58.5	Salford ...	... 57.3
Norwich ...	... 58.5	Hull	... 56.9

Portsmouth, Bristol, Newcastle, and Oldham not given.

TABLE VIII.

Per-centage of deaths under 1 year to births registered in 1874 ; average, 17.4

Liverpool ...	... 23.3	Salford ...	... 18.0
Leicester ...	... 21.9	Birmingham...	... 18.0
Leeds ...	... 20.0	Norwich ...	... 17.7
Newcastle ...	... 19.8	Hull... ...	... 17.2
Manchester ...	... 19.7	Wolverhampton	... 16.9
Nottingham ...	... 19.5	Sunderland ...	.... 16.6
Oldham ...	... 19.0	London ...	... 15.5
Bradford ...	... 18.9	Bristol ...	... 15.3
Sheffield ...	... 18.8	Portsmouth ...	... 15.1

TABLE IX.

Persons to an acre; average, 36.6

Liverpool ...	... 98.0	Portsmouth ...	... 26.8
Manchester ...	... 82.8	Salford ...	... 25.7
Nottingham ...	... 45.5	Newcastle ...	.. 25.2
London ...	... 45.1	Bradford ...	... 22.6
Bristol ...	.. 43.3	Wolverhampton	... 20.9
Birmingham..	.. 43.0	Oldham ...	. 18.5
Hull... ...	... 36.0	Sheffield ...	... 13.3
Leicester ...	... 33.2	Leeds ...	... 12.9
Sunderland ...	... 31.6	Norwich ...	.. 11.0

These Tables are all obtained from the Registrar General's Annual Summary for 1874.

TABLE OF STREETS WHERE DEATHS OCCURRED.

Table I.

Argyle street	3	Carley street	2
Archdeacon lane	1	Clarence street	1
Alfred street	2	Church gate	1
Abbey street	1	Clipstone street	1
Alexander street	2	Crab street	4
Abbey gate	1	Carrington street	1
Alice street	1	Cranbourne street	1
Aylestone street	1–12	Crafton street	1
Brook street	3	Catesby street	3
Belgrave gate	3	Corah street	1
Bedford street	3	Countess street	1
Bow street	2	Cardinal street	2
Birstall street	5	Calais street	1
Britannia street	4	Cumberland street	1
Burleys lane	2	Crystal street	1
Baker street	1	Church gate	1
Bay street	1	Clinton street	1
Brunswick street	1	Coventry street	1
Basil street	1	Calais place	1
Bread street	1	Chestnut street	1–36
Barston street	1	Dysart street	1
Bakehouse lane	1	Dryden street	3
Bow Bridge street	1	Denmark street	1
Buckingham street	2	Davis street	1
Bath lane	1	Deacon street	1
Burgess street	1	Duke street	1
Blake street	1–35	Diamond street	1
Church street	1	Denman street	1–10
Charnwood street	2	Eaton street	2—2
Curzon street	1	Friday street	1
Christowe street	3	Fleet street	1
Chester street	2	Frank street	2

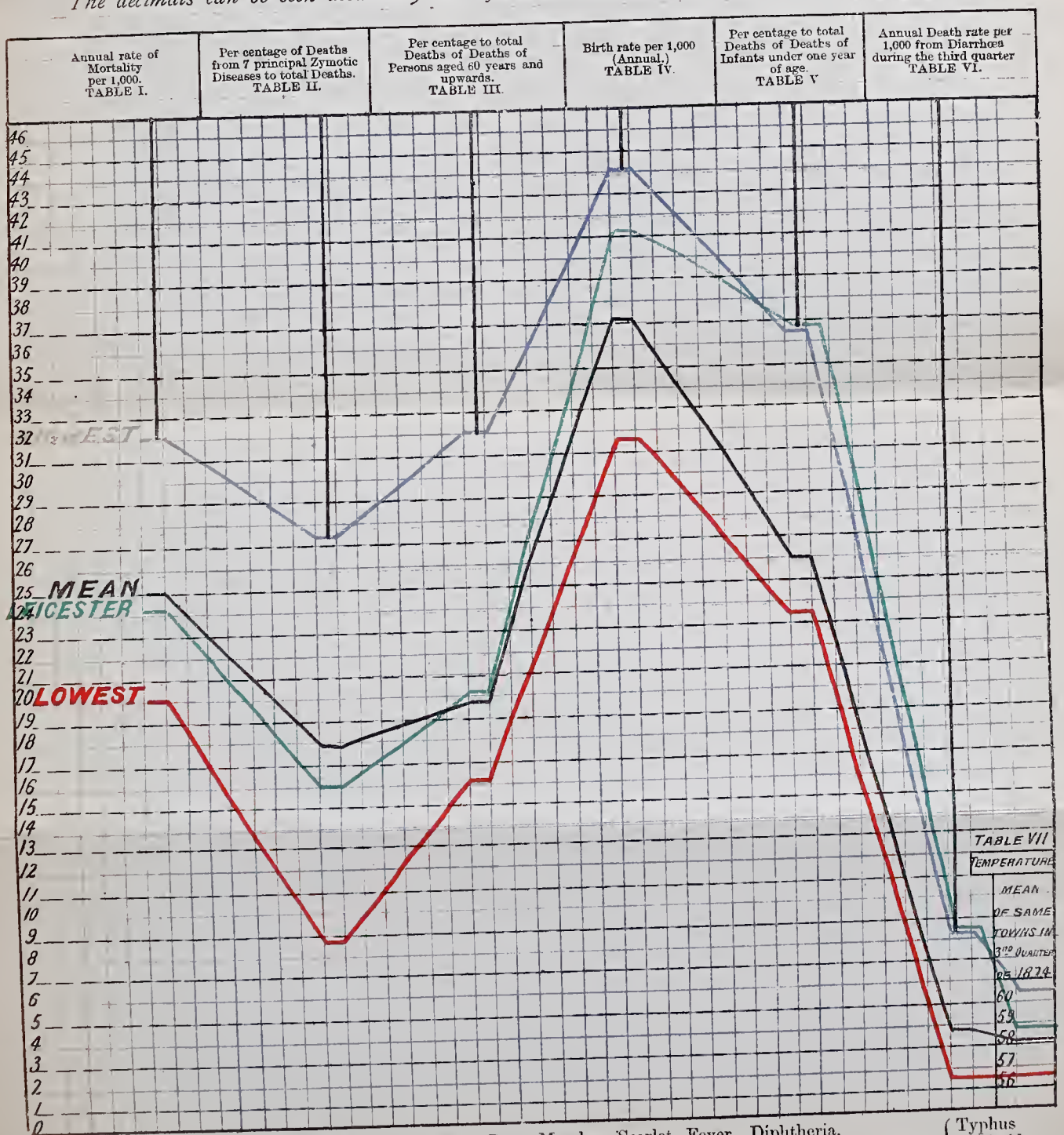
Friar's causeway ... 1
Flora street ... 1
Friar's road ... 1—7
Grosvenor square ... 1
Gresham street ... 4
Gravel street ... 2
Green street ... 2
George street ... 1
Gas street 1
Garden street ... 1
Gallowtree gate ... 1
Grange lane ... 1–14
Halford street ... 2
Hull street ... 1
Humberstone road 1
Harvey lane ... 1
High cross street ... 4
Havelock street ... 2–11
Infirmary square ... 1
Infirmary ... ... 1—2
Jewry Wall street... 1—1
Kent street ... 1—1
Lead street ... 2
Lower Hill street ... 1
Liverpool street ... 1
Leadenhall street ... 3
Lyttleton street ... 4
Lower Gosling street 1
Little lane... ... 1–13
Morlidge street ... 2
Milton street ... 3
Melton street ... 1
Mansfield street ... 4
Melville street ... 1
Magazine square ... 1–12
Northampton street 1
Nicholls street ... 2
Newby street ... 1
Navigation street ... 1
New Bond street ... 1
Narborough road ... 1
New Park street ... 1
Northgate street ... 1—9
Oxendon street ... 2
Oxford street ... 5
Olive Hill... . . 1
Old Mill lane ... 1—9
Palmerston street... 3
Peel street .. 1
Providence street ... 1
Preston street ... 1
Paradise row ... 1
Percy street ... 1
Pingle street ... 1
Pelham street ... 1–10
Rodney street ... 1
Russell street ... 2
Rudkin street ... 1
Royal Kent street... 1
Rathbone place ... 2
Red Cross street ... 2—9
Southampton steeet 2
Stanley street ... 1
Syston street ... 6
Sandacre street ... 1
Spencer street ... 1
St. George's street... 1
South Gate street ... 2
Sarah street ... 1
Sanvey gate ... 3
Soar lane 1
Sycamore lane ... 1
South Albion street 1–21
Thomson lane ... 2—2
Upper Kent street 1—1
Victoria street ... 1

Vauxhall street ... 1
Vine street ... 1
Victoria street, N. B. street ... ... 1—4
Watler street ... 1
Waring street ... 1
Wheat street ... 2
Wharf street ... 1
Willow Bridge street 1
Willow street ... 5
Watling street ... 3
Williams street ... 1
Wood street ... 1
Welford road ... 1–17
Total number (marked on the map) ... 238

THE MORTALITY CHART.

The numbers below are derived from the Registrar General's Annual Summary of the Births and Deaths of the Eighteen large Towns of England, for 1874. The decimals are of course only rendered approximately, thus 0·8 = 0·2

The decimals can be seen accurately on reference to Tables I—VII.



* The Seven principal Zymotic Diseases are Small Pox, Measles, Scarlet Fever, Diphtheria, Whooping Cough, Diarrhœa, and Fever { Typhus, Typhoid, Simple

Eighteen large Towns of England:

LONDON
PORTSMOUTH
NORWICH
BRISTOL
WOLVERHAMPTON
BIRMINGHAM
LEICESTER
NOTTINGHAM
LIVERPOOL
MANCHESTER
SALFORD
OLDHAM
BRADFORD
LEEDS
SHEFFIELD
HULL
SUNDERLAND
NEWCASTLE-ON-TYNE

Diagrams showing the Mean Temperature as observed at the Town Museum by the Curator (Mr. W. J. Harrison), during the Months of July, August, and September, 1875; together with the Death Rate Curve (from Infantile Diarrhœa) for the same period.

DIAGRAM OF MEAN OF MAX. & MIN. THERMOMETERS.

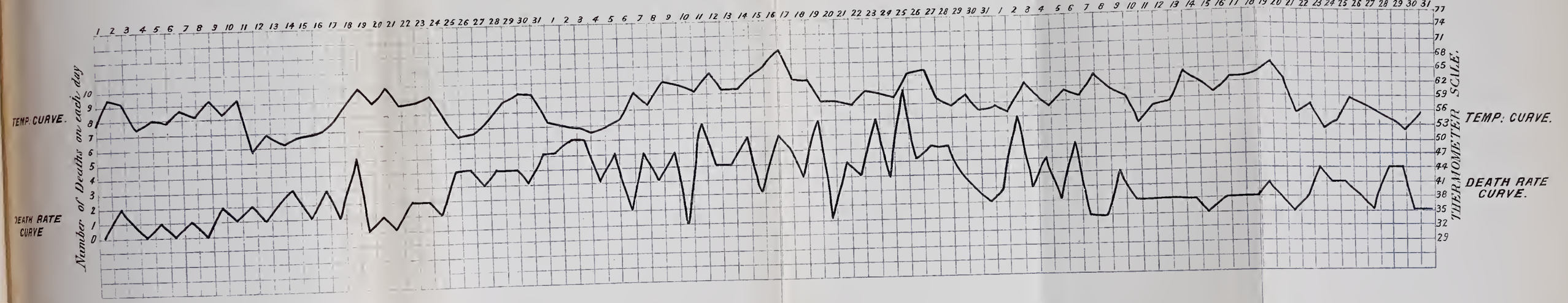
At Town Museum, Leicester, during July, 1875.

DIAGRAM OF MEAN OF MAX. & MIN. THERMOMETERS.

At Town Museum, Leicester, during August, 1875.

DIAGRAM OF MEAN OF MAX. & MIN. THERMOMETERS.

At Town Museum, Leicester, during September, 1875.



Mr Buchan's Chart.



The Weekly Deaths among Infants under one year of age on the Annual Mortality per 1,000 of the whole population. For Leicester, Curve 1; Liverpool, 2, London, 3; and Bristol, 4.

LEICESTER.

1875.

PUBLISHED BY J. & T. SPENCER, 20, MARKET PLACE
LEICESTER.

FALL AT NORTH LOCK 7 FT.

FALL AT CASTLE MILL 3 FT. 6 IN.

FALL AT SWANS MILL 3 FT. 6 IN.

REFERENCE

The spots ● Denote deaths from Diarrhœa (under 5 Years) during third quarter of 1875
The figures 15 denote the heights in feet above the Water in the Canal by the Abbey Meadow

STRATA

The Clay is shewn thus
The Sand ,,
The Gravel ,,
The Alluvial deposit ,,
Where Clay, Gravel or Sand, has been removed

SCALE OF CHAINS

Surveyed Drawn & Engraved by E. Jarman

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